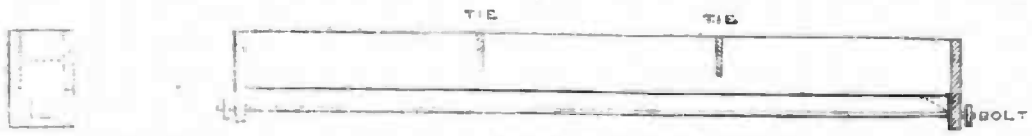
EXPERIMENTS ON THE FORM OF CAST-IRON GIRDERS.



TRANSVERSE SECTION AND END.

Exp. L.—SCALE, 2 Inches to 1 Foot.

TRANSVERSE SECTION AND END.

Exp. M.

I did not wish it to be inferred, nor did I state, that the grossest ignorance as to construction prevailed *all over* Europe at the time Brunelleschi designed the construction of the cupola. But I venture to say, that neither William of Wykeham nor William de Worde could or would have designed a cupola of such vast dimensions and substantial construction as that of Santa Maria del Fiori. But it is a fact, recorded by the historians of the time and other authentic writers, such as Vasari, &c., that the most distinguished men of science in Europe were invited to the competition. Upon that authority and upon my own studies of the monument, and not from the misuse of a florid style of expression, have I ventured upon the statements contained in my paper. If my friend, the "Inquirer," will ponder well the terms which I have used in regard to Arnolfo, he will find that I have not eulogised, except *relatively and comparatively*, his merits as an architect. He has designed and executed a great work; it is the expression of the artistic feeling of that period, and so far a valuable and interesting monument of art, and I should grieve to see the completion of the design carried out in any other taste. I think the Cavaliére Matas deserves very great credit, as the first in Italy to enter into the true spirit of archæological sentiment, that of finishing a grand monument in the style of its first conception. A different principle has prevailed with almost all Italian architects hitherto. Vignola and Palladio offered designs for the completion of the west front of S. Petronio, at Bologna, but never for that of the Duomo of Florence.—I am, Sir, &c.,

THOS. L. DONALDSON.

EXPERIMENTS ON THE FORM OF CAST-IRON GIRDERS.*

WE proceed to conclude Mr. Cooper's experiments, giving his own remarks on the results.

The experiments L are on a form which, for a want of previous experiments, I had for some years used with a great deal of confidence, and with how little propriety, is now witnessed; for although the average breaking weight is larger than either J or K, yet, from an increase of its own weight, its relative value to experiment A is the same, and its stiffness also the same, with the preceding. It has a slight advantage over them only in the facility and cheapness of its application to *single* beams, which the others have not. Indeed, to a double or box beam, cheapness would also apply if it were of any value. In reasoning upon this form of truss, the simple operation of tying the extended portions of the beam by a power superior to the strength of its own parts, subject to tensile action, would appear to be at once the object sought; but it is hereby developed, that a less elastic material must be found than wrought-iron to fulfil this condition: this must suffice upon this form of truss, and leads to the contra of this and the previous experiments, viz.:—

Experiment M, where the tension bolt is applied without an abutment or beyond the line of compression, as has lately too frequently been done, and with, in one instance at least, such lamentable effects, applied actually as an accessory to tear asunder the lower portion of such beam to which it is added; every pound from the commencement of its load exerting this influence, and only resisted by the simple strength of that to which it is an incubus. It is indeed very striking that its effect in these experiments should be in three out of four exactly alike, the breaking weights being the same, and the deflections nearly so; and if we leave out the one bearing more than the three, on account of the small excess of weight which it had, the experiments speak so determinate, that the cause passes question. Compared with the last experiments, L, it shews a deficiency of bearing weight of 20 per cent., and I have no doubt, all else being the same, such a result will invariably be borne out. In [illegible], it must be noticed, [illegible], and in No. 19 was indicated disarrangement of its particles when two-thirds of the weight only was borne.

I have thus briefly passed over these experiments, seeking rather to call attention to the laws which they exemplify and which it is futile to disregard, and to attract such attention to the same, that the subject may yet be further investigated, seeing it involves so great a responsibility upon so many; and *who*, in truth, may be excluded from an interest in it? Here, the constructor and the public are alike *one*.

I will only further remark, that it does appear to me, notwithstanding the facts here made clear, that the principle has yet to be applied, and with great advantages. I would, referring to my previous observation, suggest, as the means, abstractedly, the following:—a non-compressible piece, to be used only to withstand thrust or compression, confining or connecting together the ends of a tension bar, no one part of its figure to be liable to the action of tension for available strength; apply thereto the wrought-iron tension bar in such a form and quantity that it, and it alone, shall be that to which we look for strength to be derived from its resistance to extension; stay, or bear upwards *from* the same *to* that which resists compression, taking care that the thrust piece shall have sufficient extra elevation at its centre, that the amount of the deflection due to the load applied upon it shall not depress it without or beyond such line. This is that which occurs to me, from what has here passed before me,—a great subject for reflection, and an extensive one for experiment. With this thought I lay the foregoing before you and your numerous readers, feeling I have brought prominently before them and yourself a subject neglected, but not less of importance, hoping that it may now be taken up in such a way that that which is without doubt unexplored may be brought to light, to the mutual advantage of many of us who have hitherto taken for granted that which in reality it was our duty to have inquired into.

I here observe, that the whole of these experiments, from A to H inclusive, were made by Mr. C. Parker, of Tavistock-street, Bedford-square, and myself, and exclusively for him; and he has been kind enough to allow me to lay them before you in detail. Those following H, I have grounded upon them as a continuation of the question, with, I hope, a profitable result.

Drury-lane. GEORGE B. COOPER.

L.—Transverse Strain on Two simple Rectangular Beams, cast in one casting, connected by cross ties, &c., same as Experiment I, but trussed as per sketch annexed, or by tying the extended parts in a straight line.

The pressure applied in the same way, and bearings similar.

No. 12 Experiment. Weight, 144 cwt.		No. 13 Experiment. Weight, 140 cwt.		No. 14 Experiment. Weight, 144 cwt.		No. 15 Experiment. Weight, 134 cwt.	
Pres. in lbs.	Deflection.	Pres. in lbs.	Deflection.	Pres. in lbs.	Deflection.	Pres. in lbs.	Deflection.
220	·0025	220	·005	220	·006	220	·0025
340	·006	343	·01	325	·008	310	·005
445	·011	448	·014	445	·012	400	·0075
568	·016	568	·018	535	·014	493	·012
655	·018	658	.023	628	·017	580	·014
745	·022	748	·026	712	·02	667	·017
835	·025	847	·03	790	·022	754	·02
925	·03	937	·034	868	·025	844	·023
1018	·032	1021	·038	958	·028	934	·027
1108	·035	1099	·04	1045	·031	1039	·03
1195	·0375	1177	·043	1132	·034	1159	·035
1285	·041	1255	·048	1210	·038	1231	·038
1363	·043	1345†		1294	·042	1451	·042
1450	·046	1435‡	·066	1387	·045	1529	·045
1528	·048	1525	·069	1468	·049	1622	·049
1612	·051	1612	·072	1555	·053	1706	·052
1690	·055	1699	·075	1675	·057	1790	·056
1768	·057	1780	·078	1747	·06	1868	·058
1846	·06	1861	·083	1825	·064	1946	·062
1924	·062	1942	·087	1918	·067	2030	·066
2005	·065	2029	·091	2608	·07	2108	·069
2098	·068	2119	·096	2074	·072	2186	·072
2185	·07	2185	·1	2140	·074	2267	·075
2253	·073	2263	·104	2206	·076	2351	·078
2323	·076	2341	·108	2294	·08	2444	·082
2392	·079	2420	·112	2387	·084	2510	·085
2461	·082	2489	·115	2477	·088	2576	·087
2533	·083	2555	·118	2567	·092	2642	·09
2605	·087	2624	·122	2666	·095	2714	·093
2671	·089	2690	·125	2732	·097	2781	·097
2737	·092	2756	·129	2798	·1	2847	·1
2803	·095	2822	·133	2867	·103	2913	·104
2872	·099	2891	·136	2933	·106	2973	·107
2938	·102	2957	·139	2999	·109	3039	·111
3004	·105	3026	Broke.	3065	·112	[illegible]	·113
3094	·108			3128	·11[illegible]		·116
3160	·111			3197	Br[illegible]		
3239	·114*						
3305	·118						
3368	·121						
3425	·124						
3485	·127						
3554	·131						
Broke.							

* When this beam broke, the lever fell four inches.
† Bolt broke off at nut, and deflector fell to 064.
‡ No bolt.
§ Bolt not broken.—This casting was run deficient in part of one end, but not so as to impair the strength.
‖ Bolt not broken.
¶ Fracture central.

* See p. 610, ante.

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